

DOCUMENT RESUME

ED 157 625

PS 010 050

AUTHOR Nye, Barbara A.
TITLE Visual Motor Development in the Head Start Child.
PUB DATE [75]
NOTE 21p.; For related document, see PS 010 051

EDRS PRICE MF-\$0.83 HC-\$1.67 Plus Postage.
DESCRIPTORS Academic Achievement; Analysis of Variance;
*Perceptual Motor Coordination; Performance Factors;
*Preschool Children; Preschool Education; *Racial
Factors; Research; *Rural Urban Differences;
*Screening Tests; *Sex Differences

IDENTIFIERS *Developmental Test of Visual Motor Integration;
Project Head Start

ABSTRACT

The purpose of this investigation was to determine whether particular variables or the interaction of the variables (sex, race, and residential location), had a significant effect on the development of visual motor skills in young children. A second purpose was to develop appropriate norm tables taking into account the findings of this study. The Developmental Test of Visual-Motor Integration (VMI) was administered to 3,766 4- and 5-year-old Head Start children in one southeastern state. The research design utilized was a 2 x 2 x 3 factorial analysis of variance, and a .05 level of significance was used. There were no significant first or second order interactions for any of the groups analyzed. Sex had no significant effect on the mean scores. Race had a significant effect on the mean scores of both 4- and 5-year-old children. White children had higher mean scores than black children on the VMI. Residential location was also found to have a significant effect on the children's mean scores. There were no significant differences between the mean scores of the rural and urban children on the VMI; however, both these groups' mean scores were significantly different from the mean scores of the children residing in mixed urban-rural counties. (Author/CH)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

ED157625

PS 010050

VISUAL MOTOR DEVELOPMENT IN THE HEAD START CHILD

By Barbara A. Nye

ABSTRACT

The purpose of this investigation was to determine whether particular variables or the interaction of the variables (sex, race, and residential location) had a significant effect on the mean scores of Southeastern Head Start children on the Developmental Test of Visual-Motor Integration (VMI) and to develop appropriate norm tables taking into account the findings of this study. The data for this study were obtained from a state-wide screening of 3,766 four and five year old children conducted in the Fall of 1975.

The research design utilized was a 2 x 2 x 3 factorial analysis of variance, and a .05 level of significance was used. There were no significant first or second order interactions for any of the groups analyzed. Sex, had no significant effect on the mean scores of 3,766 four and five year old children. Race had a significant effect on the mean scores of both the four and five year old children. Four and five year old white children had higher mean scores than black children on the VMI.

The second factor found to have a significant effect on the mean scores was residential location. There were no significant differences between the mean scores of the rural and urban children on the VMI; however, both these groups' mean scores were significantly different from the mean scores of the children residing in mixed urban-rural counties.

INTRODUCTION AND REVIEW OF THE LITERATURE

One of the dimensions on which children are known to differ is perceptual functioning. Historically perceptual development was studied in laboratory settings. In more recent years, however, field experiments and field studies have played an increasingly important role in developing an understanding of perception and related phenomena, such as visual-motor development. An increasing interest is developing in studying visual-motor development as it relates to behavioral and academic achievement.

1

2

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Barbara A. Nye

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM "

If there is any consensus among the investigators, it is that perception is an active and complex process. Perception as related to visual-motor integration or eye-hand coordination as it is sometimes referred to will be defined for the purposes of this study as a process of organizing, coding, and interpreting raw, sensory input or experience (McCandles, Evans, 1973). Visual-motor integration is defined as the expressed ability to coordinate the visual and motoric systems simultaneously in order to complete a variety of tasks, such as form copying. Form copying involves simultaneous coordination of the eye and hand.

This study is concerned with the influence of three specific variables on the development of visual-motor skills. It was hypothesized that no significant differences in the scores of children on the Developmental Test of Visual Motor Integration (Berry and Bucktenica) existed between groups as a result of sex, race, or place of residence. The optimum time to study the questions of variable influence is the period of early childhood. After this time, differential practice and motivational concerns further influence and complicate the findings. Even among children at the pre-school level, important differences in interests and abilities are evident. Differences due to influences and variables (such as sex, race, and place of residence), however, are usually not as great among pre-schoolers as they are at later ages. A variable that has received little previous investigation in terms of visual-motor functioning is the influence of residential location. Do urban children have more or fewer visual-motor deficits as compared with rural children?

The review of the literature concerning the effects of gender, race and place of residence effecting visual-motor development results in contradictory findings. Goodenough and Smart (1935) questioned the existence of sex differences in visual motor development. Their study of nursery and kindergarten children showed little difference between the mean scores of boys and girls. Since 1935, several studies have examined performance on the Bender-Gestalt Test (1938) as a function of gender differences. Developmental changes on the Bender were investigated by Smith and Keogh (1963), Fielder and Schmidt (1969) and Greenberg and Alshan (1974), with no significant differences reported in the performance between boys and girls for any grade level reported. Dierks and Cushna (1969) studied children between five and sixteen years of age. Preliminary findings showed no sex difference, however, upon further study, sex was found to be a major influence on Bender performance. These findings were statistically significant and boys appeared to mature faster than girls on visual motor performance.

Although the Bender has received the most attention in research on gender differences, Beck and Talkington (1970) reported that no significant sex differences were observed on scores of Head Start children on the Frostig Developmental Test of Visual Perception (1966). The study most directly related to the present study was conducted in Tennessee. In 1973, 612 kindergarten children were screened using the VMI and two other tests. Southworth (1973) investigated the possibilities of predicting reading difficulty in first grade based on scores made on brief perceptual-motor tests. The VMI was one of the

predictor tests administered. No significant differences between boys and girls on scores for copying the geometric designs were found.

A variety of studies on visual motor and perceptual development investigating the effect of race have been conducted. The Bender was administered in a study by Greenberg and Alshan (1974). It was found that lower class black children made more errors than the normative group.

Klineberg (1928) studied blacks and whites on performance tests, concluding that the tests measure primarily speed and differences between groups due to environmental training. In tests of motor abilities of blacks and whites, Rhodes (1937) concluded that there was little if any difference between the groups at any level of development as far as motor abilities are concerned. The main conclusion of the few studies in which racial differences in motor abilities have been explored is that blacks seem to be equal or superior to whites (Rhodes, 1937). The number of such studies have been small and according to Rhodes (1937) none have dealt with young children.

Joseph Moore (1942) compared black and white children on vocabulary and eye-hand coordination tests. No statistically reliable differences between these groups were found. In a study by Stephenson (1968), results showed that race was a significant factor on subtests of the Illinois Test of Psycholinguistic Abilities (ITPA, 1968). Lesser, Fifer, and Clark (1965) concluded that ethnology

is a highly significant factor acting upon levels as well as patterns of mental abilities. Their study focused on six and seven year old Chinese, Jewish, Black and Puerto Rican children. Further conclusions were drawn concerning the interaction of social class and ethnology. Significant effects on the level of mental abilities but not on the pattern of abilities were found. The effect of social class and mental ability was more pronounced in black children than in any other ethnic group according to this study.

Weaver and Weaver (1967), found that tests measuring visual and motor channels of disadvantaged black children usually produce higher scores than those measuring auditory and vocal channels. In contrast to other studies, an investigation by Stephenson and Gay (1972) on ITPA scores of black and white children did not support research stating that lower class children are visual-motor and middle class children are auditory-vocal oriented respectively. Both black and white children showed higher visual scores than auditory scores. Children of both races exhibited considerable intersubtest variability.

In contrast to the number of investigations of gender and race differences as affecting visual-motor scores, a lengthy and detailed search of the literature in the area of the effects of place of residence proved somewhat fruitless. The only study which relates directly to this area concerned the measurement of rural and urban children on certain nonverbal abilities. This study was conducted by Eugene Shephard (1942). Overall results of the study indicate that assumptions of regional group superiority are unjustified in terms of intelligence.

With the characteristics of these studies in mind (general intellectual measures, limited sample sizes, varying socioeconomic and parental education levels, clinic groups, nonspecific visual-motor integration measures, etcetra), it is of value to examine gender, race, and locational differences among groups as possible factors having affects on visual-motor performance.

Few previous studies have looked for differences due to any of these variables at the pre-school level and none have investigated a sample of this size. In terms of variable influence, the hypotheses of this study were:

There was no difference between the average performance of 1) males as compared with the average performance of females, 2) children by race (black, white, and 3) urban and rural children on the Development Test of Visual-Motor Integration.

METHOD

Subjects - The sample for this study consisted of 4,209 Head Start children in one southeastern state. There were 1,992 boys and 2,217 girls, age three to six. Ninety-two additional children were screened; however, their scores were omitted due to the lack of necessary information on the children. The study maintained control for the variables; sex, race, residential location and income.

Design - The data were initially analyzed in order to develop norm tables taking into account the variables, gender, race, and residential location. Four and five year old VMI mean scores were analyzed for significant differences on each variable (factor) by a three way analysis of variance

procedure. The factors, sex, race, and residential were examined.

Prior to the analysis of variance, factor levels having unequal sample sizes were tested for homogeneity of variance. The Bartlett chi square test (Namboodiri, Carter, and Blalock, Jr. , 1975) was used to test the null hypothesis, which assumed equal variances among factor levels. The sample was then investigated for interaction among factors prior to independent variable investigation utilizing the Scheffe' (Kirk, 1968). The dependent variable analyzed was the VMI test scores of 2,709 four year olds and 1,057 five year olds. The analysis began with each total age group's scores in order to determine if there was any significant interaction among the three independent variables utilizing the relatively large cell sizes. Follow-up investigations were made when significant differences were found. This investigation consisted of a 2 x 2 x 3 factorial analysis of variance.

Exact residential location was determined by classifying the county in which a child lived into one of three categories based on specific criteria. Since no other directly applicable classification system had been used with such data, the system was developed by the researcher using information from the 1970 Census Report (U.S. Bureau of the Census, 1973). Rural counties are those with 35 percent or less of their population residing in urban areas. These are communities of usually less than 1,000 in population. Urban counties are those counties where 65 percent or greater of the residents live in a service area of a city of 50,000 or more or reside in an area of 2,500

or more. The third category of residence was mixed urban-rural and included counties whose population areas were greater than 35 percent urban but less than 65 percent urban.

MEASURES

One test that has been developed to assess eye-hand coordination by the use of geometric form reproduction is the Developmental Test of Visual-Motor Integration (VMI) (Berry, 1967). The test consists of 24 geometric forms arranged in order of increasing difficulty to be reproduced with paper and pencil. The VMI is designed primarily for use in pre-school and early grades (Buktenica, 1968). It measures eye-hand coordination, which is the degree to which visual perception and motor ability integrate in young children.

STUDY PROCEDURES

The children for this study were tested individually; although, the test can be administered to groups of children (Beery, 1967). Each child had a pencil placed in front of him to pick up. This was to determine handedness, which was noted on the Record Form. Children were not forced to take the test, and most responded instantaneously. If a child did not take his turn, another child was given his turn, and later the nonresponding child was given another chance. If the child never took the test, the recording form was marked unable to test.

Pass/fail criteria consisted of each child being asked to copy the drawings one at a time until he had attempted unsuccessfully to copy three consecutive figures. The test was then stopped and the raw score (number of correct forms copied) recorded.

The 30 screeners were graduate students in audiology and speech pathology except for one graduate student in child development. Supervisors, who had all received their Certificate of Clinical Competence from the American Speech and Hearing Association, accompanied the screening teams to local program screening sites, and they also screened children. All screeners including the supervisors had received training in the administration and scoring of the VMI.

Although Beery (1967) reported a .98 inter-rater-reliability quotient, an inter-rater-reliability test was conducted for the present study. Seventy-five randomly selected test forms containing a total of 656 drawings were scored independently by four testers and two supervisors.

The average inter-rater-reliability quotient consisting of all possible pairings of testers and supervisors was .90. The data was then analyzed using a 2 x 2 x 3 factorial ANOVA design.

RESULTS

Investigation of the three year old children's scores was dropped due to the rejection of homogeneity of variance on two factors, the possibility of spurious cells and the fact that three year olds are very difficult to test reliably on a test of the nature of the VMI. The result of the Bartlett for four year olds required the rejection of the assumption of equal variances for the factor, race. The calculated B was 21.50 and the critical chi square was 6.63. Both other factors (sex and residence) were found to have homogeneous variance at each level. Although the levels of one factor, race, did not vary homogeneously, the ANOVA procedure was applied. It was hypothesized that the lack of homogeneity of variance was due to the extremely large sample sizes (1,834 whites and 874 blacks), and

further analysis revealed no significant two or three way factor interaction. Also, the scores of the four year olds by race varied consistently. The application of the Bartlett for five year olds substantiated the assumption of homogeneity of variance for all levels of the three factors at the .01 level of significance.

The results of the ANOVA, which involved analysis for four interactions and three main effects are reported separately by age. The ANOVA analysis revealed no significant first order (two way) or second order (three way) interactions, therefore, the data were examined for significant main effects. The main effects analysis involved a comparison of the overall VMI means for the levels of sex, race, and residential location. The reported ANOVA results disclosed significant differences in average VMI means scores between males and females at the four year old level.

The main effect of the factor race was significant. The calculated F was 31.879 and was significant at the .001 level. The analysis showed a significant difference among four year olds on VMI mean scores between black and white children. The VMI mean score for white children (4.75) was greater than the VMI mean score for black children (4.26). The total or overall mean score for all four year olds was 4.59.

The main effect for the factor, residential location, was also significant. The factor had a significant F ratio, but further analysis was necessary to determine at what level or levels significant differences existed.

The Scheffé test (Kirk, 1968) was used to determine which level(s) residence (rural, urban or mixed urban-rural) had the mean scores which were significantly different from the mean scores of another level(s). The empirical results of the Scheffé test for four year olds at the .05 level of significance found the levels of the factor residential location to differ significantly in one way. For both the levels, rural and urban, the means differed significantly from the mean of the third level of residence, mixed urban-rural. No significant differences were found to exist between the rural and urban sample means.

The ANOVA analysis of the data on five year old children yielded the same results as the analysis of data on the four year old children. The analysis indicated, as with four year olds, that there were no significant differences in the mean scores of the male and female five year olds in the VMI. The mean score for five year old males was 6.42 and the mean score for females was 6.52.

The two factors, race and residential location, had significant differences between the levels of the factors. For the factors race, white children's mean score (6.72) was higher than black children's mean score (5.91). The calculated F ratio was 27.168 and was significant at the .001 level. The Scheffé analysis revealed that the mean scores of children from rural and urban counties were significantly different from the mean score of the children who resided in counties classified as mixed urban-rural at the .05 level of significance. The results did not show that the mean scores of urban and rural children differed significantly from each other.

The findings of the ANOVA procedure suggested the appropriateness of providing norms which took into account the significant differences between the levels of the factors race and residential location, since the norm table provided with the VMI does not take these factors into account.

TABLE I
VMI NORM TABLE

Raw Score	Male	Female
1	2-10	2-10
2	3-0	3-0
3	3-2	3-2
4	4-1	3-10
5	4-4	4-1
6	4-6	4-4
7	4-9	4-8
8	5-0	4-11
9	5-3	5-3
10	5-7	5-6
11	6-0	5-10
12	6-5	6-2
13	6-10	6-7
14	7-4	7-2

Berry and Buktenica. Developmental Test of Visual Motor Integration, 1967

The mean scores by three month intervals (quartiles) are presented for four and five year olds in Table 2. The table was developed to reflect the differences in mean scores by race and residential location. The urban and rural children's scores were combined at three month intervals, since there were no significant differences found between these two group's mean scores. The norm data for the third level of

residence, the mixed urban-rural group, are presented separately due to the findings of significant differences between this group's mean score and the urban and rural group's mean scores.

TABLE 2
VMI NORM TABLE, FOUR AND FIVE YEAR OLDS

Age In Months	White Mean Raw Score		Black Mean Raw Score	
	Urban-Rural	Mixed Urban-Rural	Urban-Rural	Mixed Urban-Rural
48-50	4.08	3.81	3.66	3.29
51-53	4.46	3.95	3.89	4.11
54-56	5.03	4.43	4.29	4.28
57-59	5.33	5.54	4.96	4.67
60-62	5.95	6.10	5.41	5.10
63-65	6.64	6.24	5.95	4.46
66-68	7.18	6.89	6.36	6.05
69-71	7.77	7.41	7.54	4.91

Nye, Barbara. A Factorial Analysis of Variance and Resulting Norm Tables for Head Start Children, University of Tennessee, 1977

DISCUSSION AND CONCLUSIONS

The purpose of this study was to investigate whether certain factors (sex, race and residence) had a significant influence on visual-motor development as measured by the VMI. It was hypothesized that the factors (sex, race, and residential location) would have no significant effect on the mean scores of the children in the sample. The null hypothesis was taken, since the review of the literature on visual motor development as measured by geometric form reproduction, indicated that the results of previous studies were primarily developed from general intellectual measures, limited sample sizes, and

samples which lacked control for specific variables such as sex, race, mental ability, socioeconomic level, etcetra. Also, the present investigation involved a larger sample than any previous studies found on measurement of visual motor development.

The VMI was normed on the basis of sex, but no indication was given in the technical report (Beery, 1967), for this division process. In the present study, however, there were no significant differences found between males and females. There were 1,266 males and 1,443 female four year olds and 527 male and 530 female five year olds. If significant differences between the sexes were to be found on the VMI, one would expect them to be present in a sample of this size. A future study of comparable size dealing with other than low income groups.

A second factor studied was race. For both four and five year olds, the differences between the mean scores of white and black children were found to be significantly different. For all age quartiles, white children residing in urban and rural counties scored significantly higher than black children residing in counties classified as urban or rural. White children residing in counties classified as mixed urban-rural scored significantly higher than black children living in counties classified mixed urban-rural. This was consistent for all quartiles except for children 51 to 53 months of age. In this quartile, black children scored higher than white children. Also, white children living in the counties classified as mixed urban-rural scored significantly higher than

urban and rural blacks. Thus, race as a factor was shown to be significant regardless of county classification with whites scoring higher than blacks.

Although whites scored significantly higher than blacks, the raw score differences up to age five years (59 months) were less than one point different. This means that white four year olds on the average copied one drawing more than black four year olds. One could conclude that this is not a large difference in performance, and this researcher would be inclined to agree that such a difference is not large at this age level. The reader should keep in mind, however, that the difference was significant. The probability that special attention should be paid to giving additional opportunities to black children to use manipulative materials and have such experiences as easel painting, etcetra is realistic. Also, care should be taken to involve the parents in the use of such materials with children in the home. It is possible that differential practice and familiarity with pencil and paper between blacks and whites is evidenced at four years of age according to the results of the present study.

The five year old blacks and whites exhibited differences in mean scores by quartiles as high as 2.76 points apart. It is possible that differences in performance on the VMI between blacks and whites increase with age. It has also been suggested in the literature that black children may be more developed in the area of gross motor skills due to several factors including modeling. In conclusion,

however, care should be taken to provide adequate visual-motor experiences for this age group (four and five year olds) for both blacks and whites with manipulative materials, which would enhance fine motor development.

The mean scores of both urban and rural children were significantly different from the children's mean scores residing in counties classified as mixed urban-rural. In the present study, black children in urban and rural counties scored consistently higher (except in one quartile) than the black children living in the counties classified as mixed urban-rural. Urban and rural white children scored higher in six quartiles than white children residing in counties classified as mixed urban-rural.

On the basis of one study, no specific conclusions concerning the effects of residence can be made. The researcher could suggest that children residing in the mixed urban-rural counties are members of families residing near factory towns. This could mean that the parents of these children had less time to spend with the children, if the parents worked irregular shifts. Also, there could be greater deprivation of materials affecting visual-motor development in these fringe areas. The researcher can only suggest that further study of the effect of residential location should be made.

Perhaps, even more important than the differences between black and white children's VMI scores and the differences between urban and rural children's VMI scores as compared with children's VMI scores living in counties classified as mixed urban-rural are

the general differences between the norms generated by this study and the standardized norms.

A question, which the present study would like to have addressed, is the seemingly rather large difference in average raw scores for four and five year olds in the established VMI norms, and those produced by this study. In comparing the two sets of norms the reader will notice the established norms showed that four year olds should score raw scores of four to seven on the VMI. The four year old Head Start children in this study scored between three and five as mean raw scores. The researcher cannot explain whether the differences are statistically significant (based on available data) but four year old Head Start children's mean scores were lower than the established VMI norms for fours.

For five year olds, the differences were even more pronounced. Five year old Head Start children had mean raw scores which ranged from five to seven. The VMI norms for five year olds ranged from eight to ten. The ranges on the two sets of norms are seeming very different. Four and five year old Head Start children's mean scores were lower than the VMI norms. It is possible that middle-class children in the standardization had more opportunities to develop the skills tested by the VMI than the Head Start children.

Head Start children in this study of 1975 screening data exhibited a 37 percent failure rate on the VMI. Thirty-seven percent is a high percentage of failures, and probably indicates that the VMI established norms are too high or that the Head Start

in this study are generally delayed in visual-motor development. The present study cannot completely answer this question, but this researcher feels that the VMI norms are probably somewhat high, and that the Head Start children are somewhat delayed in visual-motor development as measured by the VMI due to the findings of the present study. The reader is reminded of the study cited by Southworth (1973), which found the mean scores of kindergarten children approximately four months below the norms established for the VMI (Beery and Buktenica, 1967).

In conclusion, Southworth's findings would support the hypothesis that the established VMI norms are generally high for four and five year old children, not just Head Start children. Based on the findings of this study regarding the effects of gender and race, these factors also need to be taken into account in testing, readiness preparation, and enrichment programs.

The norms generated by this study seemed to be more applicable to the Head Start population in general and especially in the South east. Without additional information, inappropriate pass, fail criteria might be used in assessing the abilities of Head Start children at the present time. The VMI has been administered in four southern states to virtually all Head Start Children. The present study proved necessary, since established norm data may be generally inadequate for Head Start children and additional factors significantly affected mean group scores, which are not presently being considered.

REFERENCES

- McCandless, Boyd R. and Evans, Ellis D. Children and Youth Psychosocial Development. Illinois: Dryden Press, 1973, 190-197.
- Beery, K. E. and Buktenica, N. A. Developmental Test of Visual-Motor Integration. Chicago: Follett Educational Corporation, 1967.
- Bender, L. B. A Visual Motor Gestalt Test and Its Clinical Use. Research Monograph of the American Orthopsychiatric Association, 1938, No. 3
- Smith, Carol E. and Keogh, Barbara K. Developmental Changes on the Bender-Gestalt Test. Perceptual and Motor Skills, 1963, 17, 465-466.
- Fiedler, Mariam F. and Schmidet, Ellen P. Sex Differences in Bender-Gestalt Drawings of Seven-Year-Old Children. Perceptual and Motor Skills, 1969, 29, 753-754.
- Greenberg, Judith W. and Alshan, Leonard M. Perceptual-Motor Functioning and School Achievement of Lower-Class Black Children. Perceptual and Motor Skills, 1974, 38, 60-62.
- Dierks, Darrell, and Cushna, Bruce. Sex Differences in the Bender-Gestalt Performance of Children. Perceptual and Motor Skills, 1969, 28, 19-22.
- Beck, Ray and Talkington, Larry W. Frostig Training with Head Start Children. Perceptual and Motor Skills, 1970, 30, 521-522.
- Frostig, N. The Marianne Frostig Developmental Test of Visual Perception. Palo Alto, California: Consulting Psychologists Press, 1964.
- Southworth, Lois Gill. Predicting Difficulty in First-Grade Reading from Brief Screening of Kindergarten Children with Perceptual Tasks. University of Tennessee, 1973, unpublished doctoral dissertation.
- Klineberg, O. An Experimental Study of Speed and Other Factors in "Racial" Differences. Archives of Psychology, 1928, 15, 93, 111.
- Rhodes, Adele. A Comparative Study of Motor Abilities of Negroes and Whites. Child Development, 1937, 8, 369-371.
- Moore, Joseph E. A Comparison of Negro and White Preschool Children on a Vocabulary Test and Eye-Hand Coordination Test. Child Development, 1942, 13, 247-251.
- Stephenson, Bobby L. and Gay, William O. Psycholinguistic Abilities of Black and White Children from Four SES Levels. Exceptional Children, 1972, 38, 705-709.

Kirk, S. A., McCarthy, J. J., and Kirk, W. The Illinois Test of Psycholinguistic Abilities. Urbana, Illinois: University of Illinois Press, 1968.

Lesser, G. S., Fifer, G., and Clark, D. H. Mental Abilities of Children from Different Social-Class and Cultural Groups. Monographs Society for Research in Child Development, 1965, 30 (4).

Weaver, S. J. and Weaver, A. Psycholinguistic Abilities of Culturally Deprived Negro Children. American Journal of Mental Deficiency, 1967, 72, 190-198.

Namboodiri, Carter, and Blalock, Jr. Applied Multivariate Analysis and Experimental Designs, New York: McGraw-Hill, Inc., 1975.

Kirk, Roger E. Experimental Design: Procedures for the Behavioral Sciences. Wadsworth, 1968, 90-91.

U. S. Bureau of the Census, Census of Population. 1970 Detailed Characteristics, Final Report PC (1)-D1. U. S. Summary, Washington, D. C.: USGPO, 1973.

Beery, Keith E. Visual-Motor Integration. Chicago: Follett Educational Corporation, 1967.

Buktenica, Norman A., editor. Visual Learning. Dimensions Early Learning Series, Chicago: Follett Educational Corporation, 1968.